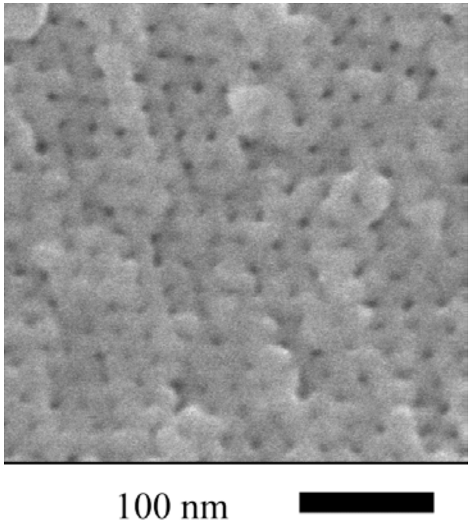
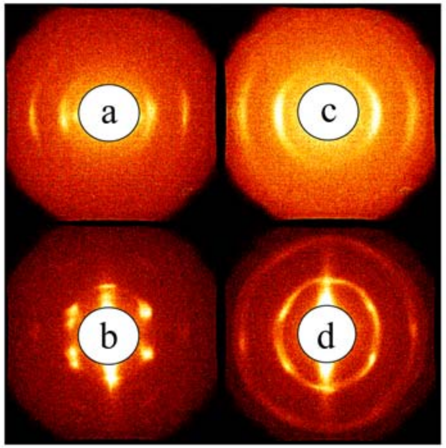
Facile Production of a Nanoporous Crosslinked Elastomer

Tim Lodge, University of Minnesota, DMR-9901097





Polymer materials offer many opportunities for contributing to advances in nano- and biotechnology. Block copolymers are well-known to self-assemble into a variety of predictable, controlled nanostructures. In this example, we have taken an elastomeric copolymer, consisting of crosslinked rubber (polyisoprene) and silicone (polydimethylsiloxane), that was organized into parallel, macroscopically aligned silicone cylinders approximately 10 nm in diameter. The cylinders were etched out with a mild chemical reagent, creating a robust, well-organized nanoporous membrane material that could be used as, e.g., a filter for biohazards or environmental remediation. The electron microscopy image above, and the lower x-ray scattering images show the alignment of the cylinders both before and after etching. We also detected that there is a minimum degree of crosslinking that will permit the matrix material to resist collapse due to the Laplace pressure.
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Education:

This work was conducted by Kevin Cavicchi (who recently received his Ph.D. in Materials Science). The work described was an "accidental" offshoot of a discovery Kevin made during his thesis research. Kevin was awarded a Doctoral Dissertation Fellowship during the last year of his Ph.D. in recognition of his excellence in research. He is currently a postdoc at UMass Amherst, and anticipates a career in academics.

Kevin Cavicchi